

REMARKS

Introductory Comments

As of the mailing date of the March 25, 2010 Office Action, claims 1-17 were pending in the present application. In the present Response, no claims have been canceled, amended, or added, so claims 1-17 remain for consideration upon entry of the present Response. Reconsideration and allowance of the claims is respectfully requested in view of the following remarks.

Nonstatutory Double Patenting Rejections

Claims 1-3, 8-10, 12-15, and 17 stand provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-6, 12, 14, and 19 of copending Application No. 10/568,458 in view of IG FARBENINDUSTRIE AG (GB290377A). 03/25/2010 Office Action, page 2, last paragraph.

Applicants thank the Examiner for pointing out the potential obviousness-type double patenting issue between the claims of the present application and those of copending application serial no. 10/568,458. In view of the possibility that claims in the cited application or the present application will be further amended before allowance, Applicants will defer responding to this provisional rejection until claims in the reference application are allowed, claims in the present application are otherwise allowable, and it is determined whether this provisional rejection becomes an actual rejection.

Obviousness Rejections over Swatloski + GB290377S

Claims 1-2, 9-14, and 17 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Swatloski et al. (WO 03/029329) in view of IG FARBENINDUSTRIE AG (GB290377A). 03/25/2010 Office Action, page 4, second full paragraph. Applicants respectfully traverse this rejection.

International Publication No. WO 03/029329 A2 of Swatloski et al. (hereinafter “Swatloski”) generally describes dissolving cellulose in an ionic liquid without

derivatization, and regenerating the cellulose in a range of structural forms without requiring the use of harmful or volatile organic solvents. Swatloski abstract.

GB290377A of IG FARBENINDUSTRIE AG (hereinafter “GB290377A”), published 05/15/1928, generally describes a method of depolymerizing high molecular weight carbohydrates.

Applicants respectfully assert that claims 1-2, 9-14, and 17 are patentable over Swatloski in view of GB290377A for at least two reasons. First, a skilled person would not combine Swatloski and GB290377A. Second, even if a skilled person had combined Swatloski and GB290377A, those references provide no expectation that starch could be selectively depolymerized as demonstrated by the current process.

1. A Skilled Person Would Not Combine Swatloski and GB290377A

Swatloski generally relates to the use of modern technology of ionic liquids for dissolution of cellulose. As discussed in the “BACKGROUND ART” section of Swatloski (see p. 3, l. 21 – p. 4, l. 2) stable room temperature ionic liquids as potential solvents had their technological breakthrough in large scale industrial processes fairly recently, in 1970’s and 1980’s. In contrast, the technology described in GB290377A is from 1927 (the filing date being 02/15/1927). GB290377A teaches the use of conventional solvents such as ethylene glycol for degrading starch into sugars, e.g. trihexosan. This known and old degradation process requires complicated and tedious processing such as boiling under reflux for several hours and distilling off solvent, e.g., ethylene glycol. GB290377A represents a mere general starting point for developing depolymerization processes further. A skilled person seeking to modify Swatloski’s cellulose regeneration method would not go back over 70 years to a reference such as GB290377A to draw an analogy between cellulose and starch based on their behavior in a conventional solvent degradation processes.

The examiner stated, “Although cellulose (β -D-glucose) and starch (α -D-glucose) have similar structures (polymer of glucose monomer), cellulose poses more challenges to hydrolyze due to its higher crystalline and lower solubility in solution.” 03/25/2010

Office Action, paragraph bridging pages 4 and 5. However, starch has also other properties disregarded in this statement. Starch has a strong tendency to form a viscous gel (i.e., gelatinization), which may complicate processing in selected solvents and available temperatures. Moreover, the amylopectin content of starch is typically about 75% whereas cellulose contains no amylopectin. Furthermore, the behavior of starch is sensitive to and strongly dependent on the ambient temperature, pressure and amount of solvent used, as discussed on page 2, line 23 to page 3, line 3 of the present application. The degradation of starch is challenging to control compared to degradation of cellulose depending on the required process parameters. Especially, selective depolymerization of starch components such as amylase and amylopectin into sugars is difficult to control or regulate, and the expected outcome is typically total degradation into small chain sugars (as demonstrated by GB290377A) or little or no depolymerization into specifiable derivatives.

Furthermore, GB290377A discloses that “attempts at a corresponding degradation of cellulose by means of glycerine have hitherto been unsuccessful”. GB290377A, page 1, lines 87-90. This can be understood as a teaching away from the presently claimed invention in that it cannot be expected that different solvents (glycerine versus monochlorhydrine) would function similarly for cellulose and starch. This teaching is clearly contrary to the Office’s suggestion that a skilled person would have applied the Swatloski process to both cellulose and starch. The behavior of starch and cellulose may be equated with each other only in specific conditions. The use of ionic liquids and microwave radiation produces considerable improvements over processing time and controllability compared to the conventional degradation process of GB290377A and cannot thus be compared thereto.

For all of the above reasons, Applicants respectfully assert that a skilled person would not have combined Swatloski with the general depolymerization method of GB290377A. The proposed combination therefore appears to be the product of impermissible hindsight motivated by a desire to find a single process applied to both cellulose and starch. The process of GB290377A cannot be expected to provide a comparable alternative to the process of Swatloski. There is no true link that would guide

a skilled person to anticipate that a totally different process would be equally suitable for the same precursors.

2. The Combination of Swatloski and GB290377A Does Not Provide An Expectation of Success for the Current Selective Depolymerization Process

Even assuming, for the sake of argument, that a skilled person had combined Swatloski and GB290377A, those references provide no expectation that starch could be selectively depolymerized.

As an initial matter, Applicants respectfully note that Swatloski is directed to cellulose regeneration, not cellulose depolymerization. To the extent that Swatloski mentions two conditions that might be construed as causing a small molecular weight loss, these conditions are either characterized as minimizing “decay of the degree of polymerization” (e.g., page 19, first full paragraph), or their association with molecular weight loss is unclear (compare, e.g., page 31, first full paragraph, associating a lack of crystallinity with a slow breakdown of polymer chains over time, with page 31, second full paragraph, associating a lack of crystallinity with a different microstructure). In short, Swatloski is concerned with converting cellulose into a different form rather than depolymerizing cellulose. So, a person seeking to depolymerize cellulose would not start with the regeneration method of Swatloski.

In the present invention the fine-tuning of the depolymerization is conveniently achieved by adjusting the temperatures, processing times and efficiency of the microwave radiation. See, e.g., present application at page 6, lines 19-32. Temperature adjustment by convective heating suggested by GB290377A is inefficient and typically produces a non-homogeneous temperature profile across the volume to be heated thus leading to uncontrolled degree of depolymerization. Microwave heating is much more convenient resulting in short and effective temperature rise and control over the whole volume under treatment. Terminating the depolymerization in the present invention is straightforward compared to, for example, the removal of the depolymerization agent by distillation in vacuo as taught by GB290377A. Both documents, Swatloski et al. and GB290377A, are silent about the fine-tuning of the molecular weight of starch components. As the

presently desired product is amylopectin the presently disclosed processing parameters aim at especially recovering this end product. See, e.g., present application at page 11, lines 11-12 and 16-17; page 12, lines 16-22; claim 6. Swatloski does not teach or suggest that degradation could be controllably fine-tuned for obtaining particular intermediates. Nor does Swatloski provide processing conditions enabling such a recovery. Neither of the cited references nor their combination teaches or suggests how to obtain amylopectin from starch. In the cited references, the depolymerization or decomposition of starch or cellulose is discussed only generally, without teaching or suggesting the recovery of specific intermediates, as demonstrated by the present process.

3. Summary

A skilled person would not combine Swatloski and GB290377A because they teach very different process. And even if a skilled person had combined Swatloski and GB290377A, those references do not teach or suggest that starch could be selectively depolymerized (e.g., to yield amylopectin instead of mere simple sugars comparable to the trihexosan obtained by GB290377A). For either and both of these reasons, a *prima facie* case of obviousness has not been established. Applicants therefore respectfully request the reconsideration and withdrawal of the rejection of claims 1-2, 9-14, and 17 under 35 U.S.C. § 103(a) over Swatloski in view of GB290377A.

Obviousness Rejections over Swatloski + GB290377 + Bergstrom

Claims 3-8, 15, and 16 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Swatloski and GB290377A in view of Bergstrom et al. (US 4,000,032). 03/25/2010 Office Action, page 7, first paragraph. Applicants respectfully traverse this rejection.

Swatloski and GB290377A are described above.

U.S. Patent No. 4,000,032 to Bergstrom et al. (hereinafter “Bergstrom”) generally describes a process is provided for freeing cellulose fibers from lignocellulosic material. Bergstrom abstract. Bergstrom is cited as allegedly “teach[ing] that, if desired, superatmospheric and subatmospheric pressures can be used. (Abstract, col. 4, lines 43-49. col.5, Example, claims 9-10)”. 03/25/10 Office Action, page 7, third paragraph.

Applicants respectfully assert that claims 3-8 and 15-16 are patentable over Swatloski, GB290377A, and Bergstrom for the reasons discussed above in the context of the rejection over Swatloski and GB290377A.

Claims 3-8, 15, and 16 each depend ultimately from and further limit claim 1. As described above, claim 1 is patentable over the combination of Swatloski and GB290377A because a skilled person would not combine Swatloski and GB290377A, and because even if a skilled person had combined Swatloski and GB290377A, those references provide no expectation that starch could be selectively depolymerized. Claims 3-8, 15, and 16 are therefore patentable over Swatloski and GB290377A. The addition of Bergstrom, which is cited for teaching the use of subatmospheric and superatmospheric pressures, does not cure the deficiencies of Swatloski and GB290377A because Bergstrom does not provide a reason for a skilled person to have combined Swatloski and GB290377A, nor does Bergstrom cure the failure of Swatloski and GB290377A to provide an expectation that starch could be selectively depolymerized. The combination of Swatloski, GB290377A, and Bergstrom therefore fails to support a *prima facie* case of obviousness against claims 3-8, 15, and 16. Applicants therefore respectfully request the reconsideration and withdrawal of the rejection of claims 3-8, 15, and 16 under 35 U.S.C. § 103(a) over Swatloski, GB290377A, and Bergstrom.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance is respectfully requested.

It is believed that all the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130 maintained by Applicants' Attorneys.

Respectfully submitted,

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